

blished, viz., *G. spinicaudus*, *G. claripes*, and *G. tuberculatus*; a fourth, *G. pumilio*, smaller than the other, is founded on a portion of a lower jaw. Some general observations on the osteology of the genus are added.

The next portion of the work is called "Fauna Argentina, Part I., Fossil Mammals." It commences by a geological description of the fossiliferous region, and then follows a list of the fossil mammals of the "diluvian" deposits, with some remarks upon each. This list comprises, of Carnivora, *Machairodus neogæus*, of which the museum possesses a nearly complete skeleton discovered in 1844 near Lujan, about fifty miles west of Buenos Ayres. A short account of the osteological character of this interesting specimen is given, and a full and illustrated description is promised in one of the future numbers of the work. We have also *Felis longifrons*, *Canis protalopex*, *Canis avus*, *Mephitis primeva*, *Ursus bonariensis*. With regard to Marsupialia, it is singular that no remains of this group have hitherto been found in the diluvial deposits of the region in question, although, as is well known, they are not infrequent in the Brazilian caves explored by Lund. The list of fossil rodents includes *Myopotamus bonariensis*, *M. antiquus*, *Ctenomys bonariensis*, *Lagostomus angustidens*, and *Cavia breviplicata*. In the Edentata, the district is of course especially rich. Notices are given of *Megatherium americanum*, *Myodon giganteus*, *M. gracilis*, *M. robustus*, *M. darwini*, and a plate is devoted to the illustration of details of the osteology of these two genera, especially the hitherto little known sternum, sternal ribs, and hyoid bones. Then follow *Scelidotherium leptcephalum*, *S. cuvieri*, *Megalonyx meridionalis*, and *M. jeffersoni*. The genus *Glyptodon*, now divided into several sections, is represented by the following species: *G. (Panochthus) clavicaudatus*, *G. (P.) tuberculatus*, *G. claripes*, *G. (H. phlophorus) asper*, *G. (H.) elongatus*, *G. (H.) lævis*, with several species but incompletely known. Numerous details are given of the osteology of these animals, with three plates of illustrations, one containing a view of a complete skeleton of *G. asper*. Under the head of Pachydermata, the teeth of two extinct species of horse, *E. curvidens* and *E. devillei* are described and figured, further notes are added on *Macrauchenia*, together with a complete view of the skeleton, and a restored outline of the animal with a slender elongated pendant proboscis, and some valuable details are given on the genus *Toxodon*, for the first knowledge of which, as in the case of *Macrauchenia*, we are indebted to Darwin's collection, described by Owen. Three species are now distinguished, viz., *T. burmeisteri*, *T. owenii*, and *T. darwini*, appropriately commemorating the three distinguished naturalists by whose labours the history and affinities of this singular form have been made known. Three plates are devoted to the illustration of this genus. The list concludes with *Mastodon humboldtii*, to the osteology and dentition of which one plate is assigned.

The next and concluding section of the volume is entitled "Fauna Argentina, Part II., Mammifera pinnata." It is devoted to an account of the marine mammalia of the republic. Of the Pinniped Carnivora, *Otaria jubata* and *O. falklandica* are mentioned. The Manati is stated not to occur in the Argentine rivers. The Cetacea are represented by *Pontoporia blainvillii*, *Delphinus microps*, *D. obscurus*, *D. cymodoce*, *Lageno-*

rhynchus ceruleo-albus, *Orca magellanica*, *Phocæna spinipinnis*, *Globiocephalus grayii*, *Epidodon australe*, *Balaenoptera bonariensis*, *E. palachonica*, *Sibbaldius antarcticus*, and *Megaptera burmeisteri*.

A very detailed description is given of the external characters and anatomy of a newly discovered species of Ziphius, named by Dr. Burmeister *Epidodon australe*, which is not only valuable as being one of the most complete and fully illustrated accounts we possess of the structure of any Cetacean, but especially as the members of the particular group to which this one belongs are all exceedingly rare, or, at all events, have a remarkable habit of keeping out of the way of naturalists, and, consequently, are less known than almost any other section of the Mammalia. Descriptions, more or less detailed, are also given of the following new species:—*Globiocephalus grayii*, and *Orca magellanica*, both founded on characters of the skulls, which are figured. The former has much larger and thicker teeth than any other members of the genus to which it is referred. *Phocæna spinipinnis* is characterised not only by the numerous and regularly placed horny tubercles on the anterior edge of the dorsal fin (which are also frequently found, though in a more rudimentary condition, in the European porpoise) but also by the peculiar form of that fin, the anterior edge being concave, and by the conformation of the skull.

Not less valuable than the anatomical description of *Epidodon australe* is the article which concludes the work, which is a full and excellently illustrated account of the external characters and anatomy of a very singular and aberrant form of dolphin, hitherto but imperfectly known, called *Pontoporia blainvillii*. This animal is one of the smallest of the Cetacea, being but five or five and a-half feet long when adult. It inhabits the estuary of the river Plata and the adjoining parts of the ocean, but it is not truly fluviatile, like the *Mia* of the Amazon and the *Platanista* of the Ganges, to which two forms it presents some structural affinities.

We trust that the brief outline which we have given of the contents of the first volume of these "Anales" will be sufficient to show that it is a book indispensable to every good scientific library, and, in conclusion, we wish to express our cordial hope that the inhabitants and government of Buenos Ayres will continue zealously to carry on the creditable work they are doing for science in keeping up and augmenting their valuable museum, and that Dr. Burmeister will long continue to be the exponent of its treasures.

W. H. FLOWER

RECENT PETROGRAPHICAL LITERATURE I.

Lehrbuch der Mineralien und Felsartenkunde. Von Dr. F. Senft. Jena. (London: Williams and Norgate.)

THE future historian of Geology who shall describe the rise and progress of the science in England, will find material for one of his most curious and interesting chapters in tracing out the causes which checked the growth, and finally all but extinguished the very existence of petrographical study in this country. While in all that relates to stratigraphical geology, we have kept well ahead of other nations, and have been quite abreast of them in palæontology, we have allowed petrography, or the study

of rock-species, to fall into disuse. For half a century we have been content to make shift with vague, incorrect names invented in the infancy of the science; our progress in this respect since the early days of M'Culloch, Boué, and Jamieson, having been simply *nil*. More especially is this true of our nomenclature of igneous rocks. While we have unravelled the complicated stratigraphical structure and relations of these rocks with unrivalled labour and detail, we have left aside the questions touching their mineralogical ingredients and chemical composition, and their classification as mineral compounds. English petrography does not exist; what we have in its stead is an indefinite obsolete grouping of rocks patched up with occasional borrowings from the Continent. And yet, strange to say, it is in England that the most important step in modern petrography has originated. Sorby's application of the microscope to the study of rocks has opened a new era in the science, and our good friend Sorby himself is regarded as a kind of demi-god in the eyes of our German brethren of the hammer. But even his wand, though it has raised up a new army of zealous petrographers on the Continent, has, as yet, failed to quicken the dry bones of English petrography. Mr. David Forbes is our *spes altera Roma*. Our waiting eyes have been turned to his laboratory in York Place, Portman Square, for years past. His materials are vast, his enthusiasm great, and his intention fixed, to retrieve the honour of English petrography. May his shadow never be less until long after his wishes and our hopes are fully realised!

They manage things petrographical very differently in Germany. There the study of rocks is introduced into the curriculum of schools and universities. It is treated of in many excellent text-books. It is eagerly pursued by zealous investigators from Berlin to Vienna. The great paper of Mr. Sorby, published here thirteen years ago, has done much to quicken this research by showing that the older methods were in many respects untrustworthy. These methods were based primarily upon chemical analysis. But such analysis, while it reveals the ultimate chemical constitution of the rock, may not explain its mineralogical composition. The various stages of the metamorphism of the component minerals are thereby often lost sight of. Hence two rocks, having by analysis approximately the same chemical composition, may differ materially from each other in mineralogical composition. It is here that, as Sorby showed, the microscope comes in to our aid, and shows what the different mineral ingredients of the rock are, how far they have respectively undergone alteration, how they are built into each other so as to form the rock-mass, and under what conditions they may originally have been formed. This important addition to the methods of research has so powerfully affected petrography, that this branch of science must be regarded as at present in a transition state. Many of the groups of rocks in the nomenclature now in vogue in Germany will require reconsideration. More especially is revision needed in those based upon subdivisions of the triclinic feldspars. Petrographers are now coming to see that, in a vast number of cases, it is not possible to discriminate the particular species of feldspar in a rock, further than as belonging to the orthoclase or plagioclase division. In this separation the microscope becomes of essential importance.

A small pile of German petrographical literature has accumulated on our table, and we propose in this and a subsequent paper to notice the more important works. The first volume that comes to hand is another publication of that most voluminous writer, Dr. Ferdinand Senft, Professor of Natural Science, Eisenach. He seems to issue a goodly octavo every year, though possibly the past year's political events may have interrupted his labours for 1870. The present work is entitled "A Text-book of Mineralogy and Petrography," and contains some 700 pages. One would have thought that the Doctor had hardly left himself room for such a book as this, when we remember not only his former special treatises on the subject, but his text-book of "Forstlicher Naturkunde," one of the volumes of which is devoted to geognosy, soils, and chemistry. And yet the book differs materially from any of his former works, and, if we mistake not, is likely to be at least quite as useful. It is not designed to be an elaborate methodical text-book, but one in which the teacher and pupil will find all the material they require for a successful and methodical study of minerals and rocks, and also one which will prove sufficient for the student in his early inquiries, even without the help of a master. The author has had peculiar advantages for the compilation of such a book. In an interesting preface he tells us that for a quarter of a century he has been engaged in teaching these subjects to the two higher classes in a school, and he details the method of instruction which his experience has found to be successful. He had used the best mineralogical treatises as text-books in his classes, but had always found them too difficult for use in schools. Accordingly in 1860 he brought out a little "School Text-book of Mineralogy and Geognosy," which, having been out of print since 1866, he has remodelled and enlarged into the present work.

The general plan of the book is like that of the ordinary German text-books, only the first or mineralogical division occupies about five times more space than that devoted to petrography. It is of the latter that we have at present to speak. Retaining the usual grouping of crystalline and fragmental rocks, the writer gives a clear and succinct account of each subdivision and species. His plan for the specific details somewhat resembles that in his earlier work on the Classification of Rocks, but with some improvements. Under each species of rock, a clear but brief description of its leading features is given in large type, then follows an equally concise account of its varieties, transitions, mode of weathering, geological occurrence, and geographical distribution. The notes on the weathering of the different rocks, and the general remarks on that subject in the introductory part of the petrographical section, go some way to supply a want which every beginner soon discovers to exist in other manuals. The same commendation may be given to the descriptions of the various kinds of *débris* and soil formed by the decay of rocks.

As a school-book, the present volume seems likely to prove useful. The arrangement into short subdivisions, each clearly marked in the mode of printing, and treating each rock in the same method, will facilitate the progress of a class, and give precision to the inquiries of a beginner. Were there only any general taste for such pursuits in our own country, we might hope to see the book translated and adapted for use in our colleges and schools. At the

same time, we are bound to notice what appears a very serious defect in the volume. The author has ignored recent microscopical research, and instead of giving that method a distinct and prominent place in his account of the investigation of rocks, he contents himself with the old "dry way" and "wet way" of analysis. In so doing, he tacitly confesses himself to be behind his time. His compilation, useful as it is, will, we hope, ere long be superseded by another, when petrography has had time to compose itself again into something like clearness and symmetry. In the mean time, the student who wishes to go more fully into the matter, will still find Zirkel's "Lehrbuch" his best guide, though even that valuable manual is fast getting out of date; owing to the great progress which the last few years have witnessed in this branch of geology. That progress has been largely shared in by Zirkel himself, as will be shown in a subsequent paper.

ARCH. GEIKIE

OUR BOOK SHELF

Der Zoologische Garten. Zeitschrift für Beobachtung, Pflege und Zucht der Thiere. Herausgegeben von Dr. F. C. Noll. XI. Jahrgang, 1870. (Frankfort a. M.) (London: Williams and Norgate.)

THE "Zoological Garden" is, as its name imports, a periodical especially devoted to all that is connected with the maintenance of animals in what are commonly called "Zoological Gardens." Having been founded some ten years ago by the Zoological Society of Frankfort-on-the-Main, it more especially relates to the affairs and condition of the small but well-arranged garden belonging to that Society, which is situated in the environs of that free and ancient city. It may appear somewhat surprising that a journal devoted to a subject of apparently so limited an extent can achieve sufficient circulation to command success. But the number of zoological gardens, aquarium houses, and similar establishments in Germany, has considerably increased of late years, and their institution in nearly all the principal cities of the Fatherland has been very favourably received, so that it is easy to understand that a considerable amount of popular interest in these subjects has been excited. Hamburg, Cologne, Dresden, Berlin, Hanover, and Munich, have all flourishing establishments of this description, and although the Zoological Garden founded some years ago in Vienna has come to an untimely end, yet in every part of what is now the new Empire of Germany the prospects of such institutions seem to be extremely favourable. But our "Zoological Garden" by no means entirely confines its attention to animals in captivity. It likewise contains many excellent articles relating to the habits of birds and beasts in a state of nature, so as to embrace many of the well-known attractions of a popular magazine of Natural History. Occasionally also more strictly scientific articles, such as that of Professor Pagenstecher on the Anatomy of the Cape Hunting Dog (*Lycaon pictus*) in the numbers for July and August last year, are given, so that the result is a zoological miscellany of a very various character. The woodcut illustrations are, it is true, perhaps not always in the highest style of art, but we have seen many inferior in English popular works of Natural History, and they have generally the merit of being tolerably correct. To such of our readers therefore as are growing weary of the "Zoologist," and cannot appreciate the learning of the "Annals," we recommend a trial of the "Zoological Garden," it being pre-supposed, of course, that they understand the language in which it is written (which in these days is a matter of course!). The subscription-price is very

moderate, amounting only to about 8s. per annum for the twelve numbers, and the journal is regularly forwarded through the post to this country.

P. L. S.

The Marvels of the Heavens. By Camille Flammarion. From the French, by Mrs. Norman Lockyer. With 43 Illustrations. (London: R. Bentley, 1870.)

THE French certainly have the art, which we have not, of putting science in an attractive form to the popular mind—attractive, and yet not at the expense of scientific accuracy. Good service is, therefore, done by the translation into easy and graceful English of works like this by M. Flammarion. From the very commencement he carries the reader with him by his enthusiasm. Instead of starting with a bare statement of facts—that the Sun is the centre of the solar system, that it is so many hundred thousand miles in diameter, and has this, that, and the other planet revolving round it at such and such distances, he takes his reader out with him, as it were, to behold the heavens on a starry night; explains how it is that we see the sun only during a portion of the twenty-four hours; and speaks of the arrangement of the stars in clusters and nebulae. Then he descends from the stars as a whole to a particular one, the Sun, and proceeds to describe in detail the solar system. And, throughout, the subject is treated with a graceful fancy and a wealth of illustration which make it very charming. Old Greek myths and fables of the astrologers, quotations from Byron and Lamartine, from Bryant and Victor Hugo, anecdotes of the value of astronomical knowledge, are brought in to point the moral and adorn the tale, and never appear to come amiss, or to be beside the mark. We must say a word about the illustrations, which are extremely good. We have never seen anything that so well recalls to our mind the appearance of the heavens through a powerful glass as Fig. 21, a part of the constellation of the Swan, as seen through the telescope; on the opposite page is placed, by way of contrast, the same seen by the naked eye. Author, translator, and artist have combined to produce a book which ought to be in the hands of every one who desires an introduction to "The Marvels of the Heavens." B.

Geology. By Prof. John Morris, F.G.S., and Prof. T. Rupert Jones, F.G.S. First series. Heads of Lectures on Geology and Mineralogy, in several courses from 1866 to 1870, at the Staff and Cadet Colleges, Sandhurst, by T. Rupert Jones, F.G.S. (London: Van Voorst, 187c.)

THIS book can hardly be called a Manual of Geology; it is rather the *avant-coureur* to the book which is to be written presently. It is a series of outlines for a course or courses of lectures, furnishing in a brief and concise form the heads or texts for any number of geological discourses which a Science teacher may be called upon to give: or the student may take it as his guide to the main lines and branches of geological study, along which he may have to pursue his readings in preparing himself, either alone or with the assistance of a "coach," to pass his "B.Sc.," or other examination at any one of the Universities. Now-a-days, when a man has to coach up so many different subjects in so short a time, it is obvious that, the more handy and concise a book is, the more useful will it be in helping to the desired end. One thing more seems to us to be needed in order to render this book of practical utility to the *uninitiated*; it is, to give, under each head, references to the authors (with chapter and verse) whom the student or teacher should consult, to gather more fully what is here only hinted at, often in but six words or less. To those who are already read up in Geology and Palæontology, the book is a most useful form of "Remembrancer," containing besides numberless facts—the key-notes to whole discourses on the earth and its past history.

H. W.